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AUTHOR Self, Charles C.
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ABSTRACT

The need for and uses of high technology delivery systems in education are discussed in this paper with respect to the community college level. After part I introduces the topic, part II links the need for new technology in education to the change in the nature of knowledge from a small, relatively static corpus to a large and continually changing one, and to the shifts in the age distribution in the population, which has resulted in increasing numbers of older students interested in lifelong learning and education outside of the traditional school setting. Part III considers the value of distance education, demonstrating its responsiveness to problems such as access, fear of returning to class, cost, student recruitment, and limited resources. Part IV reviews selected distance education technologies, including public broadcasting television, instructional television fixed services, cable television, video cassettes, video discs, teleconferencing, computer-assisted instruction, and data-based instruction. Each technology is considered in terms of its advantages, disadvantages, and uses. Part V analyzes difficulties in implementing these delivery systems, listing start-up costs, lack of faculty time and experience, and resistance on the part of the target group as the primary obstacles to be overcome. Finally, Part VI proposes the retraining of liberal arts faculty in community colleges as a key strategy in overcoming the obstacles related to the implementation of distance education technologies. (LL)

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AN OVEPVIEW OF EDUCATIONAL TECHNOLOGIES

and

IMPLICATIONS FOR STAFF DEVELOPMENT

at the

COMMUNITY COLLEGE LEVEL

PRESENTED BY

CHARLES C. SELF

at

University of Massachusetts-Amherst

May, 1983

U.S. DEPARTMENT OF EDUCATION
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Table of Contents

I	Introduction	1
II	The Need	2
III	The Value of Distance Education Technologies	4
IV	Selected Distance Education Technologies	8
	A. Video	8
	1. Public Broadcasting TV	8
	2. Instructional Television Fixed Services	9
	3. Cable Television	10
	4. Video Cassettes and Video Discs	10
	B. Teleconferencing	12
	C. Computers (CAI)	14
V	Difficulties in Implementation	19
VI	A Strategy	21
VII	Bibliography of References Cited	30

INTRODUCTION

OR

THE ART OF SELLING A BETTER MOUSE TRAP

My father was one of the best salesmen I have ever known. He believed that in life one is usually either selling a product or one's self. It was with this view in mind that he taught me the principles of salesmenship. He said, " Son, some people think that if you invent a better mousetrap the world will beat a path to your door. That is a crock. It has to be sold!". He firmly believed that it was crucial that a salesman believe that his product will benefit the customer. This is significant for two reasons. First, it gives the salesman the feeling that he is helping people and that his job has a greater purpose than merely a monetary one. Second, since it is to the customer's benefit to buy the salesman's product then the salesman can not take "no" for an answer. It is simply a matter of talking to the buyer until he or she sees that it is to his or her benefit to buy. With this noble cause in mind, the salesman makes his call.

A customer's first reaction is usually, " I don't have mice in my house!". The salesman must then demonstrate that the customer does indeed have mice in his or her house. The buyer's second reaction is usually, " So what? I don't bother them and they don't bother me!". The salesman must then point out the health hazards and potential social embarrassment of having mice in the house. With the need established, the customer's next reaction is, " I have an old mousetrap and don't need a new one.". It is then that the salesman must explain how his mousetrap is superior to the old one. Wheh the customer runs out of objections he or she will usually buy. If the salesman was correct and the product does benefit the customer, the customer will recommend the mousetrap to others. When there are enough satisfied customers the salesman can sit back and take orders.

It is with these principles in mind that I organized this paper. I believe a "better mousetrap" exists.(High technology delivery systems) I will attempt to show that there is a need for this " mousetrap" and indicate the reasons I think it is "better". My salespitch will then focus on specific

delivery systems. This overview of delivery systems will be followed by a discussion of the obstacles facing the implementation of such technologies and potential mechanisms to overcome the obstacles. The reader should be forewarned that he or she is about to buy a better mousetrap!

THE NEED

or

THERE ARE MICE IN THE HOUSE

The need for implementing new technologies in education can best be defended on the grounds that the role of post-secondary education is changing. There are two forces acting to produce this change. First, there has been a recognition of the change in the nature of knowledge (Ingalls,1973). Second, there has been and will be a change in the population served by higher education (Leach, 1979).

Ingalls (1973) states that most educational theories have been based on the belief that the fundamental purpose of education is the transmission of the totality of human knowledge from one generation to the next. This is a reasonable assumption provided that two conditions are true: (1) the body of knowledge is small enough to be effectively managed by the educational system and (2) the rate of change in the society is slow enough to permit the knowledge to be packaged and delivered before it changes. These conditions are not true in modern America as knowledge, technology and social attitudes are changing so rapidly that a single individual could live through three or four cultural periods.

The second factor which is forcing a change in the role of post-secondary education is the age distribution of the population of the United States. (This argument applies only to institutions whose primary interest is teaching, as a university could exist solely for research purposes.) During the thirty years following the Second World War, post-secondary education enjoyed extraordinary growth caused by an increase in the pool of 18-20 year olds (Tucker, 1982). When the "Baby Boom" crashed, many institutions of higher learning were saddled with under-utilized facilities and an excess of faculty. As an act of survival, many institutions began looking to an older age group as a

source of students (Leach,1979). This has proven to be a viable option. Bunker Hill Community College and many others have been very successful in maintaining their enrollment.

Recent information suggests that this trend will become even more pronounced over the next several years. Several weeks ago Chancellor Duff predicted that by 1987,due to declining birth rates,the pool of traditional "college age" students will be reduced by 40% (Duff,1983). In addition,this pool of potential students will be further diminished by the needs of the military. In 1990,the military will require one out of every three highschool graduates for the national defense (O'Neil,1983).

If the data presented above are true then it is possible through inductive reasoning to derive three generalizations. If an individual can not learn all the information needed for life during the years of formal schooling,then to be educated that person must continue to learn beyond the school years. If,in the coming decade,the institutions of higher learning are to remain healthy and vigorous, then they must draw students from an older population than in the past. If the first of these generalizations is true,then it may be concluded that,if the colleges can provide these services,post-secondary education has a meaningful and useful role in the coming decade.

Since the legitimate survival of post-secondary education rests on the first of these generalizations being true it might be well to consider it in detail. This concept has been expressed as the philosophy of lifelong learning. Cropley (1982) describes lifelong learning as follows:

> The basic notion underlying recent discussions of lifelong learning is quite simple. For various reasons,it is no longer satisfactory to conceptualize learning as something that takes place almost exclusively during childhood. On the contrary,it is important that people learn in a systematic and purposeful way throughout their lives. The reasonsfor this state of affairs have been discussed extensively by Cropley and Dave (1978). Such reasons encompass the possibility that childhood may not be the best time for learning certain things as well as the increasing necessity for adults to aquire new vocational skills in the light of industrial change.

Having seen what lifelong learning is,it might be well to consider what lifelong learning is not. Lifelong learning is not to be equated with life long schooling. If this is true then it logically follows that this knowledge need not be acquired in schools or school-like settings. Higher education does not have a monopoly on life-long learning. Indeed any supplier,public or private,can choose to supply the service. Work-related education is,to a large extent,being carried out by employers themselves and nontraditional suppliers (Tucker,1982). Lifelong learning is not a "paper chase" for degrees. Even today,the student body in a typical urban community college will include many who already possess bachelor's degrees or higher (Gannon,1983). In fact the degree system may soon break down. Competencies,rather than the degree held,may be the factor in determining who is the teacher and who is the student.

While most proponents of lifelong learning place a heavy emphasis on job skills,it should be noted that there are opportunities for the liberal arts also. Research has shown that the majority of learning projects of adults of age 55 and older are concerned with self-development. Fewer than 10% were concerned with job advancement (Hiemitra,1975). The U.S. Census Bureau counted 25.5 million people over the age of 65 in 1980 and predicts that by the year 2000 that number will increase to 30.6 million (Donlan,1983). What a potential pool to draw from! Of course some of these individuals will be senile,but more will be bright-eyed and capable of learning (Cropley,1982).

THE VALUE OF DISTANCE EDUCATION TECHNOLOGIES

Hopefully,at this point I have developed two concepts:(1) post-secondary education is or should be moving toward the philosophy of life-long learning,and (2) learning does not have to occur in schools or school-like settings. These concepts are important as some of the arguments which follow are based on the assumption that these ideas are true.

At this time I want to consider how distance education and new communications technologies may be of value in dealing with this new type of old student. It has been suggested that;"in trying to define and classify distance-learning systems,it is unwise to be too dogmatic,for

there are more mongrels than pedigrees in this field " (Smith & Stroud,1982). With this good advice in mind I shall try to be general in my description. Distance education involves the following concepts;(1) the separation of teacher and learner,(2) it differs from private independent study by the influence of some type of educational organization,(3) it involves the use of technical media to transmit educational content between student and teacher,and (4) in some cases provides for physical meeting of student and teacher for educational or social purposes.

The new distance technologies may be of value in recruiting students. Recruiting is simply selling the services of an institution to perspective students. Therefore,it is important to keep the principles of good selling in mind. We have already established through the concept of lifelong learning that the product being sold is of value to the student. The next step is to meet the objections of the customer. In 1980,The Institute for Work and Learning completed a study of union workers concerning their interest in continuing their education and their knowledge of company tuition refund programs. Below are the reasons most often given for not returning to continue their education (Elcher & Wilson,1982).

(1) Overtime shift work and other work scheduling problems
(2) Inability or unwillingness to pay tuition up front
(3) Fear of returning to the classroom
(4) Adult responsibilities which conflict with schooling (including child care problems)
(5) Grade level requirement for reimbursment
(6) Lack of information about college programs
(7) I'm too old to return to school
(8) Red tape in educational institutions
(9) Lack of management emphasis on the importance of education for personal growth

Items 1 and 4 in this list are problems of access. Instructional

JUL 8

format can be as real a barrier to access as physical barriers or distance. Any form of instruction which requires the student to appear in person on a campus or satellite campus can eliminate many adults from continuing their education. Concern for the conflict between work and education is a legitimate problem for older students. In dealing with young people,who have not yet entered the job market,or have dead-end jobs,it is easy to emphasize the value of education over work. However,one can not expect an older individual to give up a career to pursue a course of study which may or may not lead to a better job. In single-parent households the mother or father probably does not have the economic resources or the desire to leave children with a baby sitter all day while at work and in the evening while at school. Elderly and handicapped individuals often have limited mobility and even short distances present an impossible barrier to education.

The distance education technologies offer an easy solution to the problem of access. These techniques permit the student to learn at home and,in some cases,set his/her own schedule of study.

The distance technologies are invaluable as an approach to overcome the fear of returning to the classroom. Individuals maintain a sense of security remaining at home. Additionally,interesting psychological events occur when using some of the technologies. Goleman (1983) notes that:

> Communication by computer breaks down social barriers that might otherwise stifle people. For example,students are less hesitant to ask questions of professors through computer networks than in person. The computer network can also overcome status biases. In group discussions,people of lower status speak up more and are given a better hearing. Indeed,on a computer network,it is often unclear what a speakers social status is. The computer in short,offers a more egalitarian, if free-spirited interchange.

If this is true it offers a perfect method for involving shy people in education.

The distance educational technologies can provide cost-effective educational opportunities. The original cost of setting up distance education

courses is high. (Smith & Stroud,1982) However, once the technology is in place and an optimum number of students enrolled in a course, the marginal cost to serve additional students is quite small in comparison with traditional classroom instruction. In addition, original courseware can be sold or rented to other institutions. As an incentive to develop such courses, some colleges are allowing faculty who are involved in production to collect a portion of the royalties. In short, the cost to both the consumer and the public in general can be reduced through the use of distance education technology.

The Institute of Work and Learning, in the study of union workers noted previously, also obtained the preferred method of instruction for the sample. In this sample, 56.7% preferred television or video cassettes over all other methods of instruction. One tenet of the philosophy of a good salesman is that the customer is always right. If it can be demonstrated that TV instruction is as effective as traditional instruction then why not utilize T.V.? If an individual can be enticed into college via telecourse and experiences success, it might help to erase the objection voiced by many; "I'm too old to learn!" The recruiting process may be enhanced by having some of the offerings of the college on television. If a college had time on cable TV, it could effectively use some of this time to advertise it's other offerings. This could help to counteract one of the problems cited in the study by the Institute of Work and Learning, ie, lack of information about college programs. Perspective students would be exposed to up-to-date information on available college programs.

Perhaps one of the most valuable aspects of distance education is that it allows for more effective use of limited resources. One of the problems facing many administrations is acquiring personnel qualified to teach high technology courses. At the present time, individuals who possess the necessary skills are not willing to work at the payscales prevalent in education. Therefore, it is important that those individuals who possess competencies which are in demand be available to as many students as possible. The use of forms of media which will allow a faculty member to instruct hundreds of students at a time would be cost effective. Fantastic FTE numbers could

be generated by simply allowing students to learn at home.

At this point it should be noted that the use of high technology delivery systems could address 6 of the 9 most common objections offered by adults for attending college.

SELECTED DISTANCE EDUCATION TECHNOLOGIES

At this point I would like to examine some of the distance education technologies. Of all these devices, Video is the most popular among consumers and suppliers of information. A recent study revealed that 71% of the nearly 3000 colleges and universities in the United States made use of television (Shively, 1982). Television was used either as a supplement to classroom instruction or as a method of delivering entire courses through open circuit broadcast. Elcher and Wilson (1982) report:

> We sampled 10,000 of our 97,000 households who are members of our Video Club of America to assess their interest in enrolling in college courses on video cassettes to be viewed in their homes. The following profile has emerged from this survey: The great majority of respondents (86%) indicated interest in enrolling in college courses on video cassette to be viewed at home on a video cassette player. Respondents were interested in taking videocourses for the following reasons: College credit (27%); upgrading career skills (33%);personal gain (41%);pursuit of a total degree program (22%)...

Video or television is a rather diverse group of technologies and includes such things as: (1) Public Broadcasting TV (2) Instructional Television Fixed Services (ITFS) (3) Cable TV and (4) Video cassettes and Video discs. There are other video-related technologies which will not be discussed because they do not resemble commercial television.

Perhaps the most familiar of these Video delivery systems is Public Broadcasting TV. While it is possible that commercial TV could be used to broadcast educational programs, the costs for educational institutions would be prohibitive. The Corporation for Public Broadcasting (CPB) was created by the Public Broadcasting Act of 1967 to facilitate the full growth and development of non-commercial, educational radio and television nation-

wide (Bodwell,1980). These stations operate on the same frequency range as do commercial stations (Curtis,1980). As a result, they require costly high-powered transmitters designed to transmit information over a wide geographic area.

This technology has been used very successfully in other countries. In England, the Open University was the first university to be established solely to teach adults at a distance (Smith & Stroud,1982). It has proven to be very successful and has served as a model for many other nations (Smith & Stroud, 1982) However, in the United States Public Broadcasting has some unique limitations as a medium of instruction. These stations must compete with commercial television and, as a result, their programming must contain a high entertainment appeal (Curtis,1980). During the evening hours when most adults are available for instruction, Public Broadcasting stations must deliver general-interest programs. Their services are not available for educational purposes at a time convenient for adult learners. In addition, the Public Broadcast stations must follow the same decency code as commercial TV, thus restricting some types of subject matter. Perhaps most importantly, it is not possible to collect user fees using this technology. A viewer not interested in college credit may simply view the show and gain whatever information he or she can. This can be circumvented to some extent by requiring the viewer to purchase some type of learning aid in order to follow the program (Shively,1982). Public Broadcasting seems to have its greatest value as a medium for cultural development and enrichment.

Another broadcast medium available to education is Instructional Television Fixed Services (ITFS). Stations using this medium transmit in the 2000 megacycle range (Curtis,1980). In 1971, the FCC set aside 28 channels for the exclusive use of non-profit educational programs. An individual institution may operate up to four television channels for transmission in a limited area as well as audio channels for two-way communication (Smith & Stroud, 1982).

ITFS has a great many advantages over Public Broadcasting. ITFS stations are relatively inexpensive as compared to Public Broadcasting. Curtis (1980) states:

> ...IFTS transmitter/receiver stations currently cost approximately $100,000 to $ 150,000 compared to $ 1,000,000 to $ 3,000,000 for a public television transmission-only station or $350,000 to $400,000 for a comparable satellite transmitter/receiver station.....

While the initial cost may seem high even for ITFS, it should be noted that cost per student was $ 5.12 per year.

From a faculty viewpoint, the major advantage of IFTS is that it permits audio interaction between student and teacher. Since the station is not in competition with commercial broadcasting, they have time available during the hours most needed. The programs do not have to meet the high professional quality of Public Broadcast and the individual instructor can produce the entire show. Perhaps the greatest value from an administrative point of view is that it lends itself to the collection of fees. Since it is a two-way medium, students must enroll if they are to have the audio device installed in their homes. The great drawback to this system is the limited area it can serve.

The greatest hope for the future of educational TV is cable television. It makes use of the coaxial cable for the dissemination of television signals (Cuttis & Pence,1980). It is spoken of as a tool of the future because only about 30% of all households in the United States will have access to to cable by the mid-80's. However, by 1990 it is expected that 80% of the households will have cable TV .(Smith & Stroud,1982). Cable TV has all the advantages of ITFS plus the additional advantages of potentially greater geographic distribution at less cost. A survey taken in 1980 found that the per student cost was about $4.40 for cable as contrasted to $5.12 for ITFS systems (Curtis & Pence, 1980).

If present FCC rules stand, education should have access to this technology. It has been decreed that each cable system must offer a minimum of twenty channels with one channel dedicated to each of four areas : (1) public access (2) education (3) government and (4) leased use (Smith & Stroud, 1982).

Video cassette and video disc systems will be discussed here as an extension of televison and again in relation to computers.

While these devices have not yet been used to any great extent for distance education, the potential is there (Smith & Stroud 1982).

Nugent(1982) lists the specifications for the ideal audiovisual medium as follows:

1. It would be cost competitive with existing media.
2. It would be capable of storing and presenting a large amount of information.
3. It would be easy to keep and ship.
4. It would be durable in storage and in use.
5. It would be simple to operate.
6. It would allow image reproduction on existing equipment.
7. It would permit a high degree of user control.
8. It would allow the presentation content to be easily prepared and recorded by any user.

Video tape meets all of these requirements. At present, video discs cannot be recorded by individual users. At the Fifth National Conference on Communications Technology in Education and Training a spokesman for JAM Company stated that the cost of pressing a disc was $ 2,000 for the first copy and $ 20 thereafter. This seems excessive but Nugent(1982) states; " From the point of view of cost for multiple copies (200 or more) the video disc is cheaper than video cassette or 16mm film". Video discs are more durable than are video cassettes and this consideration furthur reduces the long term costs.

Both of these technologies have an advantage over the other forms of educational TV. In the broadcast or cable forms of transmission, the student must be available at the time of presentation. With tape or discs, the students may attend the presentation at his or her own choosing.

Television is popular with both student and educator. The question is; How effective is television as an instructional tool? The literature relating to educational TV is quite large. However, as doctoral candidates tend to say; "There is a paucity of good research in the area of the evaluation of television as an instructional tool.". Smith & Stroud (1982) make the following comment; " Even those operations that have separate research and evaluation units characteristically use rough and ready approaches to

to instructional evaluation." While better research is needed, some of that which has occured suggests that there is no significant difference between video and traditional instruction (Krohn,1982; Giles,1981). If this is true, it seems that greater use should be made of video as a method of delivery because of the other advantages it possesses over traditional classroom instruction.

A new technology which seems to be coming to the forefront in both educational and industrial training is teleconferencing (Kressel,1982). Wisconsin's Statewide Extension Network (SEEN) has put audio teleconferencing on the map. Teleconferencing operates like a huge partyline. An instructor, at one site, can communicate with students at various places around the state through microphones hooked up at each site. This network delivers 150 courses annually and enrolls over 30,000 students (Rifkin,1982).

In theory, teleconferencing is simply a group of people talking over a telephone partyline. In practice, it is made more complex than it perhaps should be. The Wisconsin model consists of two to two hundred classrooms across the state. These classrooms possess microphones and a speaker which plugs into a standard telephone jack and AC power outlets. If a student wishes to speak he/she simply presses a bar at the base of the microphone. The microphones all have a 20 ft. cord to allow easy access by students. Some of these rooms will hold up to 300 students,and have as many as 16 microphones. In the Wisconsin model an electricwriter permits the transmission,reception,and projection of visual material customarily written on a chalkboard. In other models the electronic blackboard is used for this purpose (Rifkin,1982). The electronic blackboard may function as a normal blackboard,however,the information written on it is often transmitted over telephone lines to television sets in remote locations (Smith & Stroud,1982).

Research by AT&T (Rifkin,1982) and an independent study (Rushton,1981) suggest that these contrivances work,and people actually learn. Both of these studies were conducted using material of a complex nature. The Bell study was conducted with members of the AT&T programming staff. Their objective was to learn a new computer operating system. The independent study by Rushton dealt with a workshop in recognition of TB bacilli in the Level I Laborotory. The subject content in both of these studies required the mastery of complex abstract ideas. The results of these showed that

there was no significant differences between students taught by telephone and those who had face to face contact with an instructor.

Teleconferencing as performed by Bell and Wisconsin is an expensive proposition. Rifkin (1982) notes that the cost for the Bell experiment was approximately $40,000 per-room. The cost breaks down as follows: (1) $30,000 for room construction and acoustic treatment,(2) $5,000 per-room to install electronic blackboard,and (3) $5,000 per-room for one-time installation charges for Bell services and equipment. The recurring monthly costs were around $2,500 per-month.

Personally,I question the need for such complex mechanisms. Ordinary telephones with the participants at home would probably serve as well as soundproofed classrooms and microphones. My roots are based in an area of the U.S. where a great deal of adult learning takes place over the party line. In such cases individuals will often stand for hours with their ears "glued" to the telephone while complex social information is passed in an efficient and rapid manner. It is an interesting educational system with strict discipline. Only the teacher (the caller) and one student (the person called) are allowed to interact. The others are obliged to remain silent. The speakers know that Haddy May is listening,Haddy May always listens in on the partyline. The conversation is being held as much for Haddy May's benefit as anyone elses,but if she gets excited and asks a question she is told that she is a busybody and to hang up.

In these communities this type of social communication system is almost exclusively used by women. The men prefer the small group format for gossip. It is not that females gossip more than males,it is just that they are so "dammed" efficient at it. The men have to get into the pickup truck and drive to either the feedstore or courthouse to convene their social group. This is inefficent as time is taken away from work,gasoline is utilized,and by the time they get the information it is probably out of date. I do not mean to imply that men in these communities do not talk on the telephone,they do. Men who would not touch a telephone for social discourse spend hours transmitting business and farming information.

I discuss this model for two reasons. First,individuals,male or female,

will spend a long period of time on an ordinary telephone provided the information being transmitted is interesting. In fact, ordinary telephones may be superior to microphones. Our society has almost equated telephone communication to personal contact. Even romantic information is transmitted by telephone. Second, perhaps this model suggests the legitimate use of teleconferencing. When information is possessed by one or a few individuals (such as high-tech skills) the telephone may be an appropriate technique for the rapid dissemination of that information. This would be particularly true if the information were of a type that would be quickly outdated. Of all the distance education technologies, teleconferencing requires the least preparation.

I have no evidence to support the idea that a rural partyline model would be as effective as the more cumbersome systems now in use. However, I suspect that if this model were used,with home computers replacing the electronic blackboard,that it would be just as effective and a great deal less expensive. It would certainly make an interesting area for research.

The merit of the technologies discussed to this point is that they are motivational, convenient and cost effective by making better use of limited resources. No attempt has been made to defend them on the basis that they are superior to classroom instruction.

Similarly, the computer may not be any better at teaching than the conventional methods but it offers new dimensions in education. Not only does the computer offer new possibilities, it's overwhelming presence mandates the explorations of these new dimensions.

At the present time, computer assisted instruction (CAI) is not considered a distance education technology. Perhaps this is because, at present, fewer than 5% of all personal computers which are sold are connected into any type of network (James,1983).This seems likely to change over the next five years.Modesitt(1983) sees the future computing model as a large mainframe system with stand-alone systems capable of interfacing with the larger system. Individuals would work on their own microcomputer accessing the mainframe by telephone or other interfacing mechanisms when the need for data or expensive peripherals arise. This type of setup has many advantages.

Since all users would not be accessing the mainframe at the same time it would permit a smaller system to serve as a mainframe. It would permit the poolimg of resources such as data files and peripherals. It would orovides for electronic mail and allow for teleconferencing. If the system were connectd to other networks, the amount of data available to users would be phenomenal. It would allow a user at home to have access to CAI materials.

It is, perhaps in the field of networking that the community colleges have their greatest potential to provide services in the coming decades. Many small businessmen are in an untenable position. They need to computerize to remain competitive, but the cost of the system that they may require is beyond their means. In such cases, the colleges could provide computer literacy training for the employees, assist in developing computer partnerships, and, for a small fee, permit these partnership networks to patch into the college's network. There is a need for this type of service. I have personally spoken with individuals who were utterly at the mercy of computer salespeople. This can be a dangerous situation since all salespeople do not possess the attitude that they are trying to help people.

The college network should also be made available to individuals in the community. At the present time most networks are in the hands of private enterprise (James, 1983). Since corporations are in business to make a profit the services they provide are to generate income. As a result, games, stockmarket reports, and electronic newspapers are the types of programs offered. If the computer is to ever serve the noble cause of lifting educational and cultural levels then it seems likely that the network will have to be in the hands of a public institution.

Computer assisted instruction is perhaps one of the most intriguing computer applications available to education. One manner in which CAI is applied is the tutorial approach (Walker,1980). In this approach the computer is regarded as the tutor, providing one-on-one instruction which is hopefully adjusted to the learning style of the student.The computer patiently drums traditional subject matter into the student. Masat (1981) suggests that this form of instruction can be particularly useful in teaching basic skills, computer science, mathematics and computer literacy courses.

However, he hastens to add; " Studies of CAI, however, indicate mixed results, often showing no consistent positive or negative effects on student achievement or attrition." It should be noted that Tennyson (1981) has produced some remarkable results by adding adaptive information to such programs. He questions the concept that students are capable of managing their own instruction. This is a deficiency he notes that exists in all forms of individualized instruction. He corrected this defect by adding a segment of program which advised the student as to areas of deficiency and suggested reasonable learning strategies. The results he reported can only be described as phenominal. Research at Bunker Hill Community College has suggested that student achievement in an audio-tutorial biology course could also be improved using similar techniques (Self&Rahaim,1983).

In light of Tennyson's work it would appear that this form of instruction would be of value as a distance education technology. It should be noted, however,that such programs are very difficult and time consuming to write. I would recommend their usage in subject areas that are not likely to change rapidly,or when they will be used by a large number of students in a short period of time. Otherwise they will not be cost effective.

Another method of using the computer for instruction is databased instruction. It is an approach to learning that has been utilized for years, but not satisfactorily defined by its practitioners (Kolp,1982). In practice it may be described as a series of classroom exercises in which the computer is used in the analysis of data. Kolp defines it as follows:

> ....it is important-at least in the beginning to define databased teaching as broadly as possible and to suggest that it is no more than a conscious effort to bring course-relevant data into the classroom so that students may examine for themselves the raw material of the particular discipline.....

This type of instruction usually operates by first asking a question. The answer to the question is found by the computer analysis of data. The data may be collected by the students or drawn from existing data banks. While the teaching of such material may be considered as an end in itself it is usually considered as an opportunity for students to do political science,sociology,or history. These diciplines are used to illustrate the concept because these are the fields where databased instruction is most often employed. Since the goals of this type of instruction are so broad, databased teaching does not lend itself to rigidly controlled experiments.

A third method of CAI is in the area of simulation and games. Mitchell (1982) defines a simulation as follows:

> The term simulation applies to a sequence of operations that when performed,are intended to reflect-as accurately as desired-the situation being moceled. Thus a motion picture sequence represents but does not in itself simulate the entities or events portrayed,whereas a computer program may present in color an animated sequence of events that appear to be similar but in fact differ because the precise chain of events is controlled by the computer in response to the behavior of the user.

Games differ from simulations in that they are usually competitive and intended to be fun as well as informative. Games can be played well before a student understands or can verbalize the theory. When games are used as a supplement to other forms of instruction they can be motivational. Mitchell states that research has found both simulations and games to be a very effective teaching tool.

As our society grapples with computer literacy there remains the unsolved problem of science literacy (McCormack,1983). It is in this area that I believe the computer can open new dimensions in education. When simulation and databased instruction are combined it gives a powerful new tool for problem solving. Using these tools it might be possible to create a thought system that would permit relatively uninformed citizens to make rational decisions pertaining to matters of science. Knowledge is proliferating in the sciences at such a rapid rate that journals are no longer a suitable mechanism for transmitting science information. There is talk of simply computerizing all such information in preference to publishing. Saxon (1982) has stated;"It will not be possible to give all students a through grounding in mathematics and the sciences in the course of a liberal education..." In such a situation perhaps all that is possible to teach is a few generalizations and a system of making decisions.

When the educated person of the future is called upon to make decisions he/she may no longer be required to draw solely upon internal resources. The individual will simply look at the computer simulation produced by the

experts. This model is not accepted as truth but represents a"springboard" for thought. If the model is true it should be possible through deductive reasoning to predict specific occurances. Using appropriate statistical programs and data banks,the thinking person discovers whether these events have occurred or are in the process of occurring. The lay person's approach would be the opposite of that of the scientist. Rather than predicting a future occurance through experimental design,the individual will look to the past to verify or refute the computer model. Using generalizations and pure logic the citizen of a democratic society should be able to make reasonable decisions on public policy pertaining to science.

In addition to developing the abilities to deal with abstractions,the citizen will be required to master new technical skills rapidly. It is in this area that the interfacing of videodiscs and computers offer great promise. The branching capabilities of both the microcomputer and the videodisc system permit the development of very realistic simulations and and role playing situations (Shively,1982). The potential of this mode of instruction has been widely recognized. Experimentation with interactive videodiscs is being conducted by both educational institutions (Nugent,1982), and private corporations,such as Wang Laboratories,Eastman Kodak,and Digital. JAM Production Inc. states that interactive videodisc is superior to any other training medium currently available. They justify this claim based on the fact that it combines the advantages of all other media. Such systems combine text,audio,video,and the branching powers of the computer. Ofcourse,some of JAM's exuberance may be colored by the fact that they are trying to sell their services to develop such programs. However,these systems do include all of the elements listed,thus there is some justification for this claim.

The programs for interactive videodisc which I have seen all seem to be directed at some form of training. Even those produced by educational institutions seem to be concerned with the development of some skill rather than abstract concepts. The programs which I have seen seem to indicate that the marriage of computer and videodisc has failed to "make them of one flesh". The video appears to be used in the same fashion

as television has always been used and the computer serves it's same old function. Although I have not seen it, my son reports a new interactive video game. In this game all of the actions of a character on the screen are controlled by the player. Through the microcomputer, the character can be made to walk, stop, run, draw a sword, or raise a shield. In short, the video character behaves as a robot under the user's control. This strikes me as the proper application of interactive video. There is little reason that educational games and simulations could not be structured with the same realism.

In this discussion of distance education technologies only a few forms have been mentioned. I have ignored older forms such as radio and failed to note innovations such as satellites, slow-scan television, and videotex. Any attempt to discuss all variations of distance education technology is beyond the scope of this paper. Indeed, to do justice to the media described in this paper a document of book length would be required. The purpose of the preceeding discussion was to alert the reader to technologies which are currently available to education but which are currently underutilized.

DIFFICULTIES IN IMPLEMENTATION

The most obvious barrier to the implementation of new technologies in education is cost. Most of the distance technologies noted in this paper could actually reduce the cost of education (Smith&Stroud, 1982). However, the initial investment is quite high. Public support for educational spending has declined over the past several years (Curtis&Biedenback, 1980). In 1965 the American voters approved 74.7% of all school bond issues, but by 1975 they approved only 46.3%. I do not believe that a foot note is required to substantiate the feeling that this trend has persisted into the 80's. Interestingly, the demand for more cost efficent education is not only an obstacle to distance technology but a justification for its need. This presents education with the same dilemma as many older American industries. Survival depends on producing a better product at less cost, but shareholders are unwilling to invest in modernizing

production.

Even the United States Navy is not immune to financial problems (Scanland,1983). There is a move to add 70,000 new recruits to the fleet. Since this exceeds the Navy's ability to supply trainers,they have investigated the distance technologies. According to Scanland,the failure to implement new training procedures can be attributed to three factors. First,there is a lack of interest in Congress to invest in the future and financing is difficult to obtain. Second,the Navy's antiquated purchasing procedure is so cumbersome that it is difficult to keep up with changing technology. Third,there is a lack of expertise on the part of the trainers in using new technology.

Masat (1981) lists five reasons why the computer has made little inroads into the instructional process at the University level. These reasons are as follows:

1. the research orientation of faculty who believe that research is threatened by an emphasis on teaching.
2. the need to learn a new discpline,not in a perfunctory way but at an indepth mastery level.
3. the greater reluctance of today's union members to be as innovative as their nonunionized colleagues of the past.
4. inherent conservatism of faculty who are not readily open to innovation and risks associated with computers.
5. role overload of faculty members who believe that they have enough to do without having to spend additional time and effort learning new teaching techniques and learning processes.

With the exception of factor number one,it is probably true that all of these factors are also operating at the community college level. However, the most important factor is number five. I have worked in three institutions which have been dedicated to experimentation and innovation in education. In my opinion,the limited success encountered in these institutions is related to the fact that the adminstration has tried to put "new wine in old wine skins." While the faculty are expected to be innovative,evaluation procedures continue on a traditional level. Individuals are expected to teach fifteen to eighteen contact hours per week,keep office hours,advise students,and serve on various committees.

The time needed to develop appropriate innovations must come from the faculty's personal time. This is a sacrifice that only the most dedicated are likely to make. In addition,the faculty of most community colleges today are at an age that predates technology. Many of the most dedicated do not see the potential of technology in education. Internal factors operating in the community college to prevent the mass implementation of distance technologies may be summarized as follows; (1) lack of funds,(2) lack of faculty time,and (3) lack of experience by the faculties in the use of technology.

Even if these conditions could be overcome there still exist the problem of acceptance of the target group. Field (1982) states that while many business and employee organizations have identified funds to support employee education,few employees take advantage of the opportunity. In addition,he points out that industry and business are not interested in their employees obtaining degrees. The case of AT&T is cited as an example. Each year AT&T spends some $700 million on training and education,but they offer no liberal arts courses. At one time they did,but they have now abandoned the practice. In the mid-fifties a group of managers were sent to Dartmouth,Williams,and Northwestern to study humanities courses. The project was abandoned because the company decided that such courses distracted employees from their work.

A STRATEGY

The obstacles noted above are not really as formidable as they appear. It has been said,"Money can't buy everything" but money can buy equipment and time,release time,which is needed by faculty to update subject matter competencies and educational practices. This money may soon be available from legisation such as the Tsongas bill. It seems likely that such legisation will be passed sooner or later since it appears to be directed more at helping industry than education.

For the first time in modern U.S. history the technological superiority of American industry is under serious challange (Abelson,1983). Nations, such as Japan and France,are giving direct financial support to their hi-

tech industries (Walsh,1982;Shishido,1983). Past investments have payed off for the Japanese. In 1980,U.S. industry was shocked to discover that the Japanese had captured not only a large share of the microelectronics business but actually made better integrated circuit chips (Robison,1980). Obviously,the high technology industries of the U.S. are going to require some type of government aid. It does not seem likely that the American public will tolerate Congress awarding IBM a billion dollar grant. However, it is likely that the public would approve of a grant to education for R&D and training in high-tech areas. Senator Tsongas makes the intent of his bill quite clear when he states that industry participation is required to insure that the money will be used to maintain American technological leadership (Tsongas,1983).

Community colleges should be poised like vultures waiting for the passage of the Tsongas bill. The enlightened community college which has already articulated it's role in the coming decade is the one most likely to prosper from passage of this bill. I am not aware that Massachusetts has expressed in precise form what it expects from its educational system in the next decade. However,in a recent speech Chancellor Duff (1983) did express his opinion. It might be well to examine the points he made.

Chancellor Duff stated that higher education in Massachusetts will soon be directed more toward professional training than it is at present. He suggested that the expansion of science and techinology will come at the expense of liberal arts programs,noting that 70% of the 1984 budget is to be spent on computer and engineering programs. In this speech he made another important point which is worth quoting:

> The realities of the information/knowledge era,upon which I believe we are embarking,require a new synthesis and a new understanding of education. Neither technology and science oriented education nor liberal arts education,as they are currently configured are entirely adequate for the new challenges that we will be facing during the coming decades.

My interpretation of his speech suggests three important points from a faculty point of view. First,there is going to be a reduced need for liberal arts faculty. Second,those liberal arts faculty who are needed

will have a different role than at present. Third,there will be an increased need for technical faculty. A prediction can be made if the following are true: (1) the interpretation of the speech is correct,(2) Duff's view will prevail,and (3) there is not an increase in funding for higher education. If there is a decreased need for liberal arts faculty, and an increased need for technical faculty with no increase in funding then some liberal arts faculty will have to be retrenched. Otherwise the need for technologists can not be filled. Since technology is favored over liberal arts,faculty will therefore be retrenched. If union contracts require retrenchment on the basis of seniority then,in many cases,it is the younger faculty who will lose their jobs. If it is true that younger individuals are more technologically literate than are older individuals then those most capable of creating Duff's "new synthesis" are the ones who will be retrenched. Therefore,it is likely that Duff's vision of a "new education" will not be realized unless; (1) the younger faculty are retained,and/or (2) the technological skills of the older faculty are enhanced.

In order to achieve Duff's concept of a synthesis between technical and liberal arts education I propose the following. Let us retrain the liberal arts faculty in the community colleges. There would be numerous advantages, not the least of which is a supply of instructors for the new technologies. I realize this requires a new "mind-set" in thinking. Currently teaching positions require a degree in a given subject area. In the past this was a logical requirement. If an individual possesed knowledge which approximated Truth,which is unchanging,and this knowledge had value then the individual who possessed the most knowledge had the greatest value. However,the modern view is that truth is relative and subject to rapid change. If one accepts the modern view,then it may be argued that by the time sufficent knowledge is aquired to obtain a degree,the information is likely to be out of date. In addition,if Vallee (1982) is correct and information is increasing geometrically,then it is impossible for any individual to become an expert on any subject. Therefore,sufficent competencies to function are all that may reasonably be expected of an

individual.

If this proposed training program for liberal arts faculty could be planned in conjunction with industry, it would qualify for funding under the Tsongas bill. Industry is a logical choice to participate in the re-training of faculty since the high-technology industries in Massachusetts are at or beyondthe state-of-the-art. However, there is a problem in cooperative dealings with industry. This was well summarized by James McGarry (1983), the systems based courseware manager for Digital, who said; "I don't like to send my good people to the University. I'm short-handed as it is. If the University sends someone good to me, I hire him." Obviously, industry does not wish to send it's valuable people off to train community college faculty. However, for reasons noted previously, many large high-tech industries use distance education technologies to train their own personnel. To add one or two hundred more students would cost the corporation very little in money and nothing in human resources. Any grant for the purpose of re-training faculty would, of course include a request for money to purchase hardware to allow the implementation of the distance education technologies. This approach would not only develop skills in technology but would give faculty the opportunity to experience distance education first-hand. As recipients of hardware from the government and software from industry, it is likely that the faculty will use the distance technology in their own teaching. The Russians have made great strides in computer science by stealing knowledge from American industry. Why shouldn't the community colleges make a quantum leap in the same fashion?

A dubious reader may be asking, "Does he really expect such a re-training to work, or is it all a ruse to obtain hardware?" The answer is "yes",I really do expect that such a program could work. This proposal is a method of " killing two birds with one stone.". If my intent was to simply get hardware, this could be accomplished under item #6 of the Tsongas bill. This states:

> (6) to improve educational productivity through the development of new educational methods and equipment such as computer based educational aids, and telecommunication instructional technologies; (Tsongas,1983)

My point is that the best delivery system in the world is of little value if there is nothing to deliver. At the present time, implementing these practices in the community community colleges would be like building an MX missle and putting a firecracker on top of it. The technology would make more impact than the warhead.

History suggests that such a massive staff development effort should fail. From 1960 to the very recent past, the Federal government has spent millions of dollars on inservice education (Edelfelt & Lawrence,1975). The results of these expenditures were not encouraging. In fact, it seemed as though the expenditures made no impact at all. Wood & Thompson (1980) state; " Most staff development programs are irrelevant and ineffective, a waste of time and money.". Why then should the future be different from the past? Hopefully, we can learn from history.

At this point it might be well to examine some of the deficiencies that have been identified in past inservice education programs. Bunker & Hruska (1978) have indicated that there is general agreement in the field of inservice education about certain current practices which are not fruitful. They identify ten such areas as follows:

1. There has been a lack of teacher involvement in planning and implementing programs. More often, programs have been imposed from the "top" down.
2. Programs have restricted their focus to the remedying of teacher weaknesses rather than capitalizing on teacher strengths.
3. Program objectives have not been related to the priority needs of teachers, students, and the community as each of these groups has perceived its needs.
4. Most programs focus on the teacher as an individual "solo practitioner" rather than as a member of a group.
5. Lack of evaluation with no one being held accountable for the success of programs has been a defect.
6. Inservice programs have failed to offer adequate incentives to teachers resulting in attitudes of indifference, negativism, resistance, and complacency.
7. Attendance is usually required of participants.
8. Program activities are frequently inappropriate with participants being forced into passive rather that active roles and do not center around actual problems teachers encounter in the classroom.

9. Programs tend to treat all teachers the same and are not individualized.
10. A failure to provide adequate resources, particularly time, finances and leadership, adversely affects programs (Hruska,1977,p.47).

Greek logic suggests that if these factors lead to failure then the opposite of these lead to success. While this may not be completely true, correcting these deficiencies would certainly improve staff development efforts. The literature also offers positive considerations as well as negative ones relating to staff development. Bunker (1979) presents a Belief System as a framework for making decisions about staff development. These beliefs are as follows:

1. Participants should be actively involved in solving real problems.
2. Participants' needs must be met. In order to deal with higher order needs (cognitive,self-actualization) lower order needs (psychological,security,belongingness) must be met.
3. Participants should be involved in decision-making about the design,implementation,and evaluation of their own programs. Shared decision-making increases involvement.
4. Skill acquisition is valued. Skills are the tools for solving real problems.
5. Participants respond positively to the opportunity to work from their strengths. People are more effective when they feel good about themselves. Success is built upon success.
6. Participants seem better able to apply new learnings, refine their skills and continue growing as they get feedback and support from others.
7. Growth takes time and is developmental.
8. Participants will benefit from self-initiated and self-directed learning. People are their own instruments for growth. A major aim of staff development is to help others become more self-directed.

Because of the nature and origin of the proposed re-training program, it would conform almost automatically to the Belief System. It is obvious that individuals can not be forced into mastering a discipline which is beyond their interests or abilities. Therefore, it would be mandatory that participation was voluntary. It would be the responsibility of the staff developer to identify areas where there were likely to be a high demand for

skills and the types of ability required to master these competencies. The participants would then sit down with the staff developer and find areas of personal interest. Once these interest areas were identified, consideration would then be given to the abilities required for success. In some cases, individuals will already possess many of the skills required to perform a given set of competencies. For example, most liberal arts faculty will possess a good foundation in mathematics. Utilizing the format suggested here, the participant would be involved in planning the inservice training, working from an area of strength and, in a sense, develop an individualized program. The program, resulting from self-initiated activity on the part of the participant, would not be resisted by the individual and thus there would be a high probability of success. Since the activities would be occuring via distance education technology on an individual's own campus, participants would know each other and possibly develop support systems. It seem likely that, formally or informally, study groups would arise which would provide the feedback and support which most humans require. Obviously, the project would be directed at the needs of the participants.

Generally speaking, the proposed re-training program lends itself to a good staff development project. Of course, it would have to be a continuous process designed to operate for a number of years. If care is exercised in the design of the specific program, it could be"the model" for staff development efforts.

Somewhere in the Platonic realm of existence, there is a perfect staff development program. However, even if it could be moved to this imperfect world of the senses, there is still a possibility that the project would fail. Even the most perfect program is destined to fail if too many members of the faculty are unable or unwilling to master the material. Most liberal arts faculty are relatively bright individuals with a history of academic success. Is there any reason that they may be unable or unwilling to master science or technology? . A possible obstacle that might interfer with the process is the cognitive style of the participant. Cognitive style may be defined as individual differences in processing information (Self,1983). The concept of cognitive style should not be confused with ability. Witkin and

Goodenough (1977) define cognitive style as the manner of reaching a goal as distinguished from ability the competence in achieving the goal. While there are many dimensions of cognitive style the one which has been studied the most is field-dependence/independence (Self,1983). It is for this reason that I have chosen to focus on this aspect of cognitive style.

The concept of field-dependence/independence orginally began with psychological studies on perception (Witkin,1959). Later research has suggested that FD/FI is pervasive in that its influence moves across numerous human activities including social behavior and personality (Witkin et. al.,1977). Cognitive styles are bi-polar and an individual may be identified as either field-dependent or field-independent. There is a continuum between strongly field-dependent and strongly field- independent . An individual may be placed along this continuum by the results of a variety of tests, some cumbersome and expensive. The most efficient and least expensive of these tests is the Embedded Figures Test (EFT). This test requires that part of an organized field be separated from the field (Self, 1983). In the EFT, the task is to locate a previously seen figure within a complex figure designed to conceal it. Individuals who can find most or all of the embedded figures within a certain time limit are designated as field-independent. Those who find few or none of the figures are designated field-dependent. Witkin and Goodenough (1977) state the characteristics of each group as follows:

> Among the descriptors of relatively field-dependent persons that have been identified in these studies are: like being with others, are sociable, are gregarious, are affiliation oriented, are socially outgoing, prefer interpersonal and group to intrapersonal circumstances, seek relations with others, show participativeness, show need for friendship, are interested in people, want to help others, have a concern for people, have wide acquaintanceships, know many people and are known to many people. A contrasting set of descriptors of relatively field-independent persons has included: prefer solitary activities, are individualistic, are cold and distant in relations with others, are aloof, never feel like embracing the whole world, are not interested in humanitarian activities, highly cathect intellectual activities, value

> cognitive pursuits, are concerned with philosophical problems, are concerned with ideas and principles rather than people, are task oriented....

Perhaps more pertinent to this discussion are the differences which exist between field-dependents and field-independents in their choice of careers and academic subjects. Research has shown that there is no significant difference between field-dependents and field-independents with respect to their grade point averages in college (Witkin et al.,1977). There is, however, a difference found in the choice of courses in which the grades were achieved. The study revealed that field-independent individuals preferred subjects in the mathematice and science domain while field-dependents preferred subjects that could be classified in the social and behavioral sciences area. This suggests to me that possibly there is a large segment of the population that is capable of being scientists and engineers but who have not selected these areas because they do not like s ence and possibly will never like it. Are these the individuals who are resisting the Computer Revolution? If so, can individuals with this cognitive style ever find peace in a world of machines.? I had planned to investigate these questions before writing this paper but events moved faster than I had anticipated. At this point in time, I can not answer those questions. It appears to me that this could be a fruitful area for future research.

In spite of the possibility that some individuals may resist being "cybernized", I still feel that a re-training program should be attempted. Not all faculty in the liberal arts are field-dependent and they may, indeed, welcome an opportunity to evolve and survive. Also, I suspect that there are other personalit factors of field-dependents that can over-ride their possible cognitive distaste for the sciences. Perhaps field-dependent individuals will be assimilated into the information society more freely than might be suspected. Finally, we have no choice. If relatively bright individuals with a successful academic background cannot be re-trained then there is no hope for the masses and the concept of life-long learning. I tend to believe that individuals, given a well-designed opportunity that will allow them to experience success in a non-threatening environement, will triumph.

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8118 Math-Sciences Building
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